Late in 1950, two metres, with a pair of 7193s in a unity-coupled oscillator and a modified ex radar receiver proved a little disappointing until several of the "boys" built three over three beam antennas and we were able to work all around the suburbs. However, a change in work, and the arrival of television meant banishment from amateur radio.

OUT OF RADIO FOR A TIME

Being more settled now, receiverless, transmitterless and almost junk boxless, I decided to build a receiver to see what was happening. In the middle of this construction I encountered one of my old amateur mates who told of how things had changed and advised me to call on yet another amateur who had recently *bought* some gear. And so I saw my first *Black Box* — a convincing winner.

My first transceiver was a FT-200, then came an SWR meter. With a half-wave dipole on 80 metres fed with 300 ohm ladder type TV feeder and a simple tuner and I was in business. How simple it was.

Still enjoying building, I built a Z-match tuner which is still used today and has matched several transceivers to a variety of antennas over a period, including the 80 metre dipole still in use of all HF bands, two triband quads fed with 70 ohm twin and a commercial triband beam with the same type of feed. The transceivers didn't worry because they did not, at any time, see worse than 1.2:1 SWR on 80, 40, 20, 15, and 10.

A COMPUTER IS SOMETHING ELSE

Now the computer is something else and I may have left it a little late. Nothing to build or probe with a meter, no mods or adjustments, but lots to learn and think about. It has certainly been invaluable in the preparation of this article which has been my first experience with the wordprocessor.

Much has been said, and will continue to be said about the many facets of amateur radio. While many have passed through to full time employment there will always be those who have no further wish than to participate at the hobby level, but for all there is ample scope.

I will say that many of my contempories have at some time needed the friendship and assistance of other amateurs, and for myself offer a big thank you to those who came to my aid. I am sure that the future holds much promise for amateurs who will continue to be represented in the forefront of advancement in electronics and particularly communications.

AR

THE RESONANT RHOMBIC

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The Rhombic antenna is the ultimate in simple wire arrays, where maximum gain is required in a given direction. Many radio amateurs have aspired to a Rhombic, only to be deterred by space considerations. To be effective, this antenna needs to be big.

My interest goes back to World War Two, during the closing phase of which I was associated with the US Signal Corps. The military manuals of the day described the Rhombic in great detail and encouraged the 'troops' to utilise this type of antenna, even though the conditions for its erection might not be ideal.

Forty years after WWII ended, Bill Owen, of the University of Pennsylvania, sent me a copy of a 1942 publication, after learning of my plans to erect a large wire array.

The requirements for a Rhombic are simple, some poles, lots of wire, and a good antenna tuner.

POLES

There may have been a time when a radio enthusiast could have 'won' a few poles from the local power company, or council, but those days are long gone, as I soon discovered. It took six months to find an honest timber-cutter who was prepared to cut down, and deliver, the necessary trees for QRP dollars. I selected some Iron Barks, which were growing on the side of Mount Buderim, not far from my QTH. For any conservationists who may be getting excited at this stage, may I say this was only the second time in Australian history that the sound of an axe had rung out in this particular forest, and culling is essential for proper growth and timber production.

When cleaned up, the poles were a little over 50 feet (15m) in length and were allowed to dry out for some weeks. They were then painted with preservative, fitted with climbing pegs and capped with aluminium hats. Erection of the poles was done by a commercial contractor. It is not a job for an amateur due to the large weights involved. I stuck to this theory, even though there was no shortage of volunteers from my local radio club.

Anyone who has put up a long length of wire will have gone through the problem of sag. Fortunately I had access to disposal wire consisting of a strong steel cable, with two copper wires moulded alongside. Telecom call it drop wire. Properly tensioned, this wire stays magnificently taut and a joy to behold. Only the copper wires joined together were attached to the feed line.

Each side of the antenna is 329 feet (100m) long and is run in one length via insulated pulleys mid-way.

The wires were tensioned and attached by galvanised chain and turnbuckles of robust

General view of the antenna.

proportions. Prior to the erection of the poles, there had to be a decision on which frequency was to be primary, and after a lot of information from many sources I chose a compromise apex angle, suitable for 10 and 15 metres, the 1973 Dipole and Long Wire Handbook by Ed Noll W3FQJ, an excellent reference publication. A further decision had to be made as to a suitable target for the array and, after a look at a Great Circle Map centred on Brisbane, I chose the city of Los Angeles, which gave me an extended line to New York. The reverse bearing goes across the Indian Ocean to South Africa. It was a simple matter to establish the bearing by reference to the 10 metre beacon maintained by W6IRT, from a Hollywood QTH. The beacon runs seven watts and I have used it for years. At the moment it runs practice CW at 13WPM, sending in mixed groups, which is good practice for those interested in learning the code. I aimed my Rhombic down this path.

Having chosen the target, I found I was a little short of real estate and had to open diplomatic relations with my neighbour, a widow known to have a 'peppery' temperament. I guaranteed no interference to her television reception, but she was more concerned about her horses. I received conditional approval to erect a pole on her farm as long as I did not frighten them. Simple trigonometry was used as an aid in locating the poles and determining space requirements. The actual antenna in use here covers an area of 300 feet (91m) long by 140 feet (42m) wide. Ideally, the location should be level and away from buildings. As with any antenna, it also needs to be away from the ground for maximum performance. Having said that, my Rhombic is near and over the tops of trees, the ground is not level, and the height, at average, 45 feet (13.5m) is too low. Nevertheless, it works superbly.

ANGLES

Referring to Figure 1, note that the two angles are marked, TILT and APEX. Either can be used in the design of a Rhombic; the other parameters are leg-length and height above ground. The total length of wire in the array is made an odd multiple of an electrical quarter wavelength. The whole object is to combine the major lobes of radiation so that the antenna

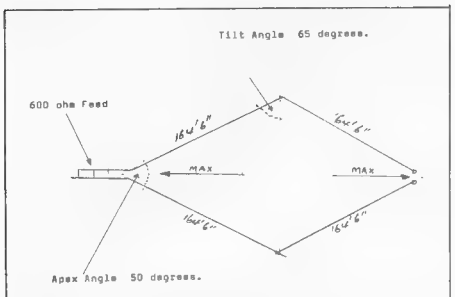


Figure 1

radiates and receives at the angles which normally are most effective for communication on the frequency to be used. Amateurs are usually attempting to achieve wave-angles of 0 to 20 degrees above the horizon. It is not within the scope of this article, nor am I competent to explore fully, Rhombic design. However, Figure 2, which is a wartime chart is included for interest.

either shortened or shielded. Remember, this antenna is capable of being operated on 160 metres through to 29MHz, and you will be lucky not to strike this trouble on at least one frequency. The antenna became operational during January 1984 and the first impressions were of incredibly quiet reception and reports from overseas amateurs indicated the station sounded better on the Rhombic. Subsequent reports show a gain of one to one and a half S points on 10 and 15 metres, and even on 20 metres, when compared with a TH6, which is no slouch on these bands. These are average observations, on many occasions the wire antenna is much better than the Yagi, in no uncertain terms. But it is in the noise-free reception that it becomes a winner.

Since the resonant Rhombic is claimed to be bi-directional, with maximum lobes in a line bisecting the apex angle, I looked forward to interesting results in the reverse direction. I duly came up on the ANZA net and was shattered to find results were terrible, with the Yagi way out in front. Baffled, bothered and bewildered, I shot off an air mail letter to W6AM

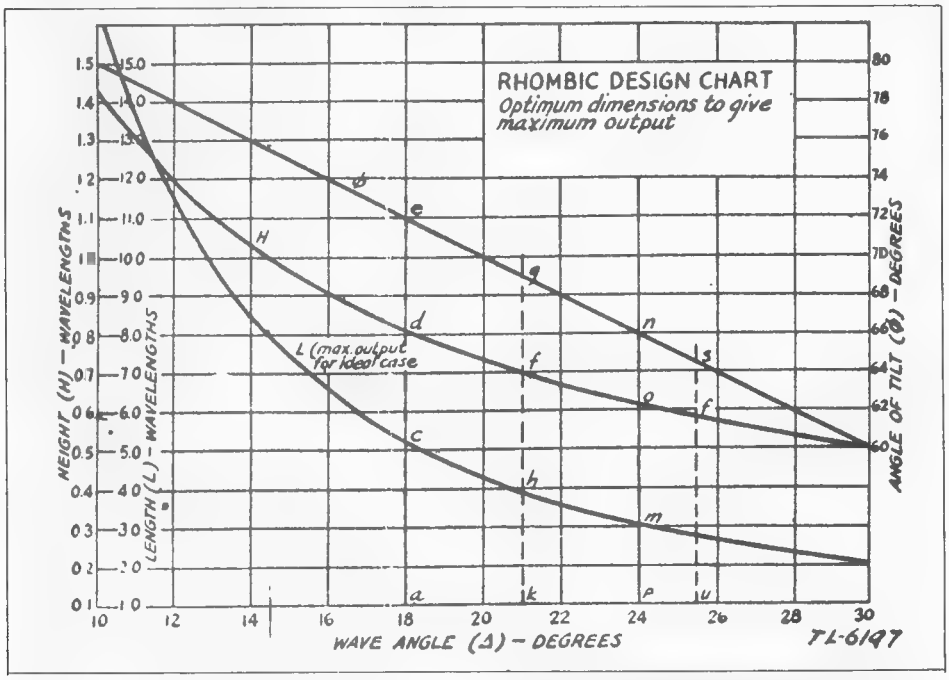
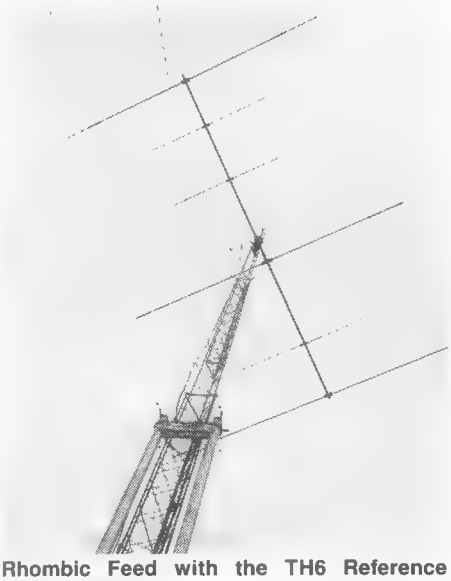

RHOMBIC DESIGN CHART
Optimum dimensions to give maximum output
HEIGHT (H) – WAVELENGTHS
LENGTH (L) – WAVELENGTHS
ANGLE OF TILT (ϕ) – DEGREES
L (max. output for ideal case
WAVE ANGLE (Δ) – DEGREES
TL-6197

Figure 2 — Rhombic Antenna Design Chart for Maximum output design. The top curve is tilt angle, middle curve, height above ground and the bottom curve is leg length. For example: If you require a wave angle above the horizon of 18 degrees, draw a vertical line through point a (18 degrees on the wave angle abscissa). The answer would be — leg length 5.25 wave lengths, height 0.81 wave lengths, and tilt angle 72 degrees.

Usually a Rhombic is fed via 600 ohm open wire transmission line. Spacing wire of gauge 14 to 20 at five inches (127mm) will achieve a characteristic impedance within the range of 600-700 ohms. Spreaders were made of perspex obtained as scrap from a signwriting company. It is beastly material to cut into strips; I found a sharp electric saw necessary. Open wire feed line is the most efficient method of transfer of RF to an antenna, and has a velocity factor of unity. It may be necessary to alter the length of the feedline to minimise RF feedback in the wireless room. While on this subject, I found it necessary to tidy up most of the leads in the shack. Wires to extension speakers, and ALC, plus relay lines to linear amplifiers were



Rhombic Feed with the TH6 Reference Antenna above.

Close view of the Rhombic Feed Line.

explaining my tale of woe. Don Wallace ran a stable of 13 Rhombics and had kindly lent me much data, collected by him over a long lifetime. His reply was — *"The books say a Rhombic is bi-directional. You and I have found otherwise. It is bi-directional only if there is a feed line on both ends. The far end is then terminated in the station, via relays. It is then capable of awesome front to back ratios, measured at 56dB here"*. It is sad to relate, Don became a silent key as I was putting this article together.

TUNER

I mentioned the need for an efficient antenna tuner. The 'Transmatch' has been around for many years, with the original circuit being published in QST. I used one until W1FB advised me of a variation on the original, called the SPC. It uses the same components but covers a much wider frequency range. It has a much better harmonic attenuation than the transmatch. In order to make it include the 29MHz FM frequencies, I found it necessary to pay more attention to layout and use copper strip, rather than wire, to connect the bits and pieces together. The balun was made from cores which are regularly advertised in Amateur Radio. These items come complete with excellent directions. The SPC circuit is featured in late issues of the ARRL Handbook.

In the 18 months that my antenna has been in operation, it has been used on all amateur frequencies. It was used on 22nd June, when the 12 metre band was opened for American amateurs, and excellent reports were received. It appears to be reasonably directive on 30 metres towards the United States, and is also used on 40 metres, in that direction, with good results.

If I could discover how to turn the farm around, I would dispense with Yagis. Since I don't ever anticipate being able to do this, I can only express my gratitude to Professor Yagi and his friend, Mr Uda, for their compact invention. 'Project Rhombic' would never have 'got off the ground' without the encouragement and practical help of Roy VK4ARU, who was a tower of strength throughout the construction phase.

AR